

Investigation of the relationship between body mass index and early childhood caries

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Abstract

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Aim: The aim of this study is to determine the relationship between body mass index (BMI) and early childhood caries by using the decayed, missing, and filled teeth (DMFT) index in early childhood.

Methodology: The sample of the study consisted of 133 children, 63 boys and 70 girls, aged 2-6 years. Dental scans of the children were performed by two experienced physicians in line with World Health Organization criteria, using mirrors and probes, in daylight. The DMFT index was employed to determine the number of DMFT. The height and weight of the children were measured and recorded with a digital scale and height ruler during the examination. BMI was calculated by dividing their body weight (kg) by the square of their height in meters.

Results: There was no statistically significant difference between age groups according to gender ($p > 0.05$). When the DMFT index values according to the BMI classifications of the children participating in the study and the number of caries, missing, and filled teeth of four different groups (weak, normal, overweight, obese) were compared according to the BMI classification, a difference was observed between the groups. The DMFT indexes of the children who were evaluated as obese with an increasing BMI had higher results than those for the other groups ($p < 0.05$).

Conclusion: More detailed and long-term studies are needed to determine the causal relationship between the variables examined when evaluating the relationship between dental caries and BMI, as well as to formulate appropriate interventions related to these variables.

Keywords: Body Mass Index (BMI), DMFT index, dental caries, early childhood caries, obesity, oral health

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Introduction

Oral and dental health are the starting point of good physical health. General health status, as defined by the World Health Organization (WHO), is “not just the absence of disease; the state of complete physical, mental and social well-being.” Oral health issues are a

leading cause of significant pain and suffering for individuals, affecting their general health by changing their eating habits, speech, and quality of life (1). Risk factors for oral diseases include an unhealthy diet, inadequate oral hygiene, smoking and alcohol use, and social factors. Oral diseases are often linked to chronic diseases, such as diabetes, cardiovascular disease, and

cancer, because they share the same risk factors (2). There is also a positive relationship between nutrition and oral health. In addition to systemic diseases, oral diseases also affect nutritional status and eating function. Likewise, nutritional deficiency affects oral health, primarily by changing the properties of enamel and increasing susceptibility to caries. For this reason, the importance of nutrition in the development of oral health is emphasized (3).

One of the most important indicators of oral and dental health is dental caries. A global goal of the WHO in terms of oral and dental health by 2000 was to reduce dental caries by 50% in children aged 6 years. In addition, the number of decayed, missing, and filled teeth (DMFT) in children aged 12 was not to exceed 3. The aim of the WHO for 2020 was to have an 80% caries-free rate in children aged 6 years and an average DMFT index of 1.5 in children aged 12 years. In Turkey, it has been reported that 85% of children aged 6 years have dental caries, and this rate increases with age (4).

The main factors affecting the risk of dental caries include dietary habits, oral hygiene, and fluoride exposure. In particular, the frequency and amount of consumption of simple sugars, which are fermentable carbohydrates, are associated with dental caries. In a study examining the relationship between nutrition and dental caries, the importance of sugar consumption frequency was emphasized, and it was determined that the consumption of sugary foods more than four times a day increased the risk of dental caries (5). The prevalence of obesity has risen worldwide due to changes in diet and lifestyle, such as physical inactivity. Recently, a fast-food diet has begun to be preferred in children, leading to high carbohydrate and salt consumption. It also causes malnutrition in terms of fiber, vitamins, and especially minerals, such as calcium (6).

Dental caries and obesity are both multifactorial diseases that impact children's health and psychosocial development and also share common, modifiable, influences such as diet and lifestyle (7). Studies have linked dental caries with childhood obesity. Anthropometric measurements are frequently used as an indicator of nutritional status to show the relationship between obesity and dental caries.

Body mass index (BMI) is one of the most widely used indices to classify obesity that measures height for weight, which is frequently used to categorize underweight, overweight, and obese persons (8). Dental caries is frequently encountered in childhood due to poor eating habits and inadequate oral care. However, there are limited studies evaluating the relationships among dental caries, food consumption, and body composition in school-age children (9).

The aim of this study was to determine the relationship between body mass index (BMI) and early childhood caries by using DMFT index in early childhood.

Materials and Methods

Before beginning our study, written approval was obtained from the Ethics Committee of Necmettin

Erbakan University, Faculty of Dentistry, Non-Pharmaceutical and Medical Devices (Ethic Committee report no:2021/04-58). The sample of the study consisted of 133 children, 63 boys and 70 girls, aged 2-6 years, who presented to Necmettin Erbakan University, Faculty of Dentistry, Department of Pediatric Dentistry with dental problems. In this descriptive cross-sectional study, the sample size was determined to be 67 people using the G*Power 3.1 program ($\alpha=0.05$, $1-B=0.95$) (Version 3.1.9.7, HHU, Düsseldorf, Germany).

Patient exclusion criteria:

- 1- Children in the primary dentition period (0-6 years old)
- 2- Systemically healthy children
- 3- Children of parents who volunteered to participate in the study

Patient exclusion criteria:

- 1- Children with physical and mental disabilities
- 2- Children with chronic and systemic diseases that may affect growth and development (chronic liver disease, chronic kidney disease, celiac disease, congenital heart diseases, genetic syndromes, endocrine disorders)
- 3- Children of parents who did not volunteer to participate in the study and did not sign the consent form

Before applying the questionnaire, children and their families were informed about the content of the study, and all parents and their literate children read and signed the Parent Informed Voluntary Consent Form and Informed Voluntary Consent Form. Families included their children in the study. After approval, the researcher filled out the questionnaire form by interviewing the mothers face to face while their children were undergoing dental examinations.

In line with WHO criteria, dental scans were performed under daylight by two experienced and calibrated physicians using mirrors and probes. The DMFT index was used to determine the number of decayed, missing, and filled teeth. The height of the children was measured using a Seca brand height meter, without shoes, in an upright position, and on the Frankfort plane (eyes and auricles at the same level and feet together). The children's body weights were measured with a Tanita BC-601F body analyzer. Accurate weight measurements (within 0.1 kg) were achieved by removing thick clothes and shoes. After measuring the body weight (kg) and height (m) of the children participating in the study, the Body Mass Index (kg/m^2) values were calculated according to the formula

$$\text{body weight (kg)} / \text{height}^2(\text{m}^2)$$

The BMIs of the children participating in the study were classified according to the WHO's BMI score classifications: extremely thin, normal, pre-obesity, and obese.

Statistical analysis

Statistical analyses of the findings obtained in the study were evaluated using the IBM SPSS Statistics V22 program (IBM SPSS Inc., Armonk, NY, USA). The significance value was set at $p = 0.05$.

Chi-square analysis was used for categorical variables. Kruskal Wallis analysis was used to compare the DMFT between the groups. A normal distribution was observed in the DMFT value in the groups according to the body mass index. Therefore, ANOVA analysis was used in comparison. Since there was a significant difference between, which groups this difference existed was evaluated by post-hoc analysis.

Results

Of the child participants included in this study, 70 were girls and 63 were boys. The ages of the children were as follows: 2 years old ($n = 1$), 3 years old 3 ($n = 19$), 4 years old ($n = 48$), 5 years old ($n = 39$), and 6 years old ($n = 26$). When gender and age groups were compared, no significant difference was found between them ($p > 0.05$). When grouping the child participants according to their birth weight, the percentile reference values for Turkish children were used. Of the

assessed children, 84.2% were in the 50th percentile for birth weight. There was no significant difference between the groups according to age and gender ($p > 0.05$).

The BMI of the children participating in the study was determined using the WHO's BMI score. According to the classification, it was made as extremely thin / normal / pre-obesity / obese. Of the child participants, 59.4% were classified as normal, and there was no significant difference between the groups in the evaluation of BMI scores according to age and gender groups ($p > 0.05$). The results showed a statistically significant difference between the DMFT values of the individuals and the BMI values ($p < 0.05$). However, according to the results of the post hoc test, there was a statistically significant difference between the individuals in the obese group and all other BMI groups, and the highest DMFT value was observed in the obese group. There was no difference in DMFT values between the overweight, normal, and pre-obesity groups. The lowest DMFT value was observed in the extremely thin BMI group (Table 1).

In terms of age and gender, when evaluating whether the children had a toothbrush and how they brushed their teeth, no significant difference was found between the groups ($p > 0.05$). Regarding the frequency of going to the dentist, 43.6% of the parents answered, "once a year." There was no significant difference between the groups in terms of age groups and gender ($p > 0.05$).

Table 1. Relationship between BMI and DMFT

	n	Average	Standard Deviation	F	p
Extremely Thin	23	6.70 ^a	3.55	7.712	0.001
Normal	79	7.13 ^a	3.48		
Pre-Obesity	23	7.65 ^a	3.97		
Obese	8	13.38 ^b	4.10		
Total	133	7.52	3.88		

* Exponential letters are used to indicate comparison between groups. There was no difference between the same letters.

Discussion

Due to the recent increase in the prevalence of obesity worldwide, studies on the possible relationship between dental caries and obesity have been carried out in the literature. In these studies, dental problems in obese and overweight children, such as caries, have been reported to be of high prevalence. Similarly, in another study conducted in a German primary school, the authors stated that there is a strong relationship between obesity and dental caries as a result of their

research on the 1290 children they studied (10). In a systematic review, these conflicting results were well interpreted, and in 48% of the evaluated studies, there was no relationship between BMI and dental caries. It was shown that there was a positive relationship in 35% and an inverse relationship in 19%. Therefore, we suggest that there is still a need for studies that investigate the relationship between BMI, dental caries, and various other parameters (11).

BMI index is used to measure children's nutritional status. Obesity, overweight, and malnutrition

(underweight) are also multifactorial conditions and effective on children worldwide (8).

Costacurta et al. suggested that BMI may not be the best method for measuring body fat because they could not reach a common conclusion on the relationship between dental caries and obesity (9).

Researchers argue that the errors in the studies may result from the classification made by measuring BMI in order to determine the relationship between child adiposity and dental caries (11, 12). More detailed and long-term studies are needed to determine the causal relationship between the variables emphasized when evaluating the relationship between dental caries and BMI and to intervene in these variables.

Conclusions

A significant correlation was found between BMI and DMFT indices ($p < 0.05$). The DMFT index was found to be higher in children who were described as obese, and they were found to have severe ECC cases. It is thought that the high amount of carbohydrates consumed affects the DMFT index. There are also studies supporting this in the literature. There is a need for further comprehensive studies on the factors that affect this relationship, including differences in dietary habits.

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Ethical Approval: Ethics committee approval was received for this study from Necmettin Erbakan University, Faculty of Dentistry Scientific Research Ethics Committee, in accordance with the World Medical Association Declaration of Helsinki, with the approval number: 2021/04-58).

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